

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. - 26. (Canceled)

27. (Original) An electromagnetic navigation system for use in navigating an instrument through an electromagnetic field positioned near a metal object, said electromagnetic navigation system comprising:

(a) a transmitter coil array having a plurality of transmitter coils, said transmitter coil array operable to generate the electromagnetic field to navigate the instrument; and

(b) a shield positioned adjacent the metal object, said shield operable to substantially shield the metal object from the electromagnetic field generated by said transmitter coil array, said transmitter coil array being attached to said shield, wherein shield substantially reduces distortion of the electromagnetic field by the metal object, thereby enabling accurate navigation of the instrument in the electromagnetic field.

28. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said transmitter coil array is integrally formed transmitting coils positioned about a perimeter of said shield.

29. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said transmitter coil array is displaced from said shield.

30. (Original) The electromagnetic navigation system as defined in Claim 29, wherein said transmitter coil array includes at least three sets of transmitter coils which are displaced from said shield.

31. (Original) The electromagnetic navigation system as defined in Claim 30 wherein said three sets of transmitter coils are displaced from said shield by an extension member.

32. (Original) The electromagnetic navigation system as defined in Claim 30, wherein each set of transmitter coils includes three sets of coils positioned orthogonal to one another.

33. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said transmitter coil array is driven in at least one of a time division multiplexed manner, a frequency division multiplexed manner or a combination of both.

34. (Original) The electromagnetic navigation system as defined in Claim 27 wherein the metal object is a fluoroscope.

35. (Original) The electromagnetic navigation system as defined in Claim 34 wherein said fluoroscope is a C-arm fluoroscope.

36. (Original) The electromagnetic navigation system as defined in Claim 27 wherein at least one of said shield and transmitter coil array is removably attached to said metal object.

37. (Original) The electromagnetic navigation system as defined in Claim 34 wherein said shield is integral with said fluoroscope.

38. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said instrument includes at least one electromagnetic sensor attached at a distal end of said instrument.

39. (Original) The electromagnetic navigation system as defined in Claim 38 wherein the instrument is non-rigid and may bend during navigation and the instrument includes a plurality of electromagnetic sensors to provide further location information regarding the instrument.

40. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said transmitter coil array is controlled over a wireless channel.

41. (Original) The electromagnetic navigation system as defined in Claim 27 wherein said instrument operates over a wireless channel.

42. (Original) The electromagnetic navigation system as defined in Claim 27 wherein the field strength of each coil in the transmitter coil array is stored on a memory medium where each field strengths takes into account interference from the metal object.

43. (Original) The electromagnetic navigation system as defined in Claim 42 wherein the memory medium is a flash ROM.

44. (Original) An electromagnetic navigation system for use in navigating an instrument through an electromagnetic field positioned near a fluoroscope, said electromagnetic navigation system comprising:

(a) a transmitter coil array having a plurality of transmitter coils, said transmitter coils array operable to generate the electromagnetic field to navigate the instrument; and

(b) a shield attached to the fluoroscope, said shield operable to substantially shield the fluoroscope from the electromagnetic field generated by said transmitter coil array, wherein said shield substantially reduces distortion of the electromagnetic field by the fluoroscope, thereby enabling accurate navigation of the instrument in the electromagnetic field.

45. (Original) The electromagnetic navigation system as defined in Claim 44 wherein at least one of said transmitter coil array is integrally formed transmitting coils positioned about a perimeter of said shield.

46. (Original) The electromagnetic navigation system as defined in Claim 44 wherein said transmitter coil array is displaced from said shield.

47. (Original) The electromagnetic navigation system as defined in Claim 46 wherein said transmitter coil array includes at least three sets of transmitter coils which are displaced from said shield.

48. (Original) The electromagnetic navigation system as defined in Claim 47 wherein said three sets of transmitter coils are displaced from said shield by an extension member.

49. (Original) The electromagnetic navigation system as defined in Claim 44 wherein each set of transmitter coils includes three sets of coils positioned orthogonal to one another.

50. (Original) The electromagnetic navigation system as defined in Claim 44 wherein said transmitter coil array is driven in at least one of a time division multiplexed manner, frequency division multiplexed manner or a combination of both.

51. – 53. (canceled)

54. (New) An electromagnetic navigation system for use in navigating an instrument through an electromagnetic field formed near a metal object, said electromagnetic navigation system comprising:

- (a) a transmitter coil operable to generate the electromagnetic field to navigate the instrument; and
- (b) a shield positioned adjacent the metal object, said shield operable to substantially shield the metal object from the electromagnetic field generated by said transmitter coil, wherein the shield substantially reduces distortion of the electromagnetic field by the metal object, wherein the instrument is operable to be navigated in the electromagnetic field.

55. (New) The electromagnetic navigation system as defined in Claim 54, wherein said transmitter coil is attached to said shield.

56. (New) The electromagnetic navigation system as defined in Claim 54, wherein said transmitter coil is a transmitter coil array including a plurality of transmitter coils.

57. (New) The electromagnetic navigation system as defined in Claim 54, wherein the transmitter coil array includes three sets of coils.

58. (New) The electromagnetic navigation system as defined in Claim 57, wherein each of the sets of coils includes three transmitter coils.

58. (New) The electromagnetic navigation system as defined in Claim 56, wherein the transmitter coil array includes a plurality of transmitter coils each oriented along a different axis.

59. (New) The electromagnetic navigation system as defined in Claim 54, further comprising:

a surgical instrument, wherein said surgical instrument is operable to be accurately navigated in the electromagnetic field at least in part because of said shield.

60. (New) The electromagnetic navigation system as defined in Claim 54, wherein said transmitter coil is integrally formed with said shield.

61. (New) The electromagnetic navigation system as defined in Claim 54, wherein said transmitter coil is displaced from said shield.

62. (New) The electromagnetic navigation system as defined in Claim 54, wherein the metal object is at least one of an operating room table, a fluoroscope, a microscope, an ultrasound hand piece, a high-intensity focused ultrasound systems, a computer topography (CT) imaging system, an interoperative computer topography, a magnetic resonance imaging (MR) system, an interoperative magnetic resonance, a surgical robot, or combinations thereof.

63. (New) The electromagnetic navigation system as defined in Claim 54, further comprising at least one of a surgical probe, a catheter, a steerable catheter, an endoscope, a shunt, a drill guide, an awl/tap, an orthopedic instrument, or a combination thereof.

64. (New) The electromagnetic navigation system as defined in Claim 54, further comprising:

 a transmitter coil controller having at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the transmitter coil controller; and

 at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the transmitter coil;

 wherein a wireless communication channel is used to communicate between the transmitter coil controller and the transmitter coil;

 wherein the operation of the transmitter coil array is controlled via the wireless communication channel.

65. (New) The electromagnetic navigation system as defined in Claim 54, further comprising:

an instrument interface having at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with said instrument interface;

at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the instrument;

wherein a wireless communication channel is used to communicate between the instrument interface and instrument;

wherein information is transmitted via the wireless communication channel.

66. (New) The electromagnetic navigation system as defined in Claim 65, further comprising:

a display operable to display navigation information.

67. (New) The electromagnetic navigation system as defined in Claim 54, wherein said shield is conically shaped.

68. (New) The electromagnetic navigation system as defined in Claim 54, wherein the shield is formed of a conductive or semi-conductive material.

69. (New) An electromagnetic navigation system for use in navigating an instrument through a field formed near an interfering object, said electromagnetic navigation system comprising:

(a) a transmitter array including a plurality of transmitter coils, wherein each of the transmitter coils is operable to generate at least a portion of the field operable to be used to navigate the instrument; and

(b) a shield positioned adjacent the interfering object, said shield operable to substantially shield the interfering object from the field generated by said transmitter coil, wherein shield substantially reduces distortion of the field by the interfering object, wherein the instrument is operable to be navigated in the field.

70. (New) The electromagnetic navigation system as defined in Claim 69, wherein the field includes an electromagnetic field, a magnetic field, or combinations thereof.

71. (New) The electromagnetic navigation system as defined in Claim 69, wherein said transmitter coil is attached to said shield.

72. (New) The electromagnetic navigation system as defined in Claim 69, wherein the transmitter coil array includes three sets of coils.

73. (New) The electromagnetic navigation system as defined in Claim 69, wherein the transmitter coil array includes a plurality of transmitter coils each oriented along a different axis.

74. (New) The electromagnetic navigation system as defined in Claim 69, wherein said transmitter coil array is at least one of integrally formed with said shield, positioned a distance from said shield, or combinations thereof.

75. (New) The electromagnetic navigation system as defined in Claim 69, wherein the interfering object is at least one of an operating room table, a fluoroscope, a microscope, an ultrasound hand piece, a high-intensity focused ultrasound systems, a computer topography (CT) imaging system, an interoperative computer topography, a magnetic resonance imaging (MR) system, an interoperative magnetic resonance, a surgical robot, or combinations thereof.

76. (New) The electromagnetic navigation system as defined in Claim 69, wherein the instrument is at least one of a surgical probe, a catheter, a steerable catheter, an endoscope, a shunt, a drill guide, an awl/tap, an orthopedic instrument, or a combination thereof.

77. (New) The electromagnetic navigation system as defined in Claim 69, further comprising:

 a transmitter coil array controller having at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the transmitter coil controller; and

 at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the transmitter coil;

 wherein a wireless communication channel is used to communicate between the transmitter coil controller and the transmitter coil;

 wherein the operation of the transmitter coil array is controlled via the wireless communication channel.

78. (New) The electromagnetic navigation system as defined in Claim 69, further comprising:

 an instrument interface having at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with said instrument interface;

 at least one of a wireless receiver, wireless transmitter, or combinations thereof associated with the instrument;

 wherein a wireless communication channel is used to communicate between the instrument interface and instrument;

 wherein information is transmitted via the wireless communication channel.

79. (New) The electromagnetic navigation system as defined in Claim 69, further comprising:

a display operable to display navigation information.

80. (New) The electromagnetic navigation system as defined in Claim 69, wherein said shield is formed of a conductive or semi-conductive material.

81. (New) The electromagnetic navigation system as defined in Claim 69, wherein the shield is positioned between the instrument and the interfering object.

82. (New) The electromagnetic navigation system as defined in Claim 69, further comprising:

a calibration sensor operable to measure the field and determine a position of the calibration sensor relative to an origin.

83. (New) The electromagnetic navigation system of Claim 82, wherein the calibration sensor is interconnected with a robotic unit to determine the position of the calibration sensor relative to the origin.